PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE HONORABLE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the Application of

Alain BETHUNE

Application No.: 09/688,961 Examiner: K. MCCLELLAND

Filed: October 17, 2000 Docket No.: 107615

For: METHOD OF HOT MARKING, AND A MULTILAYER STRUCTURE FOR IMPLEMENTING SUCH A METHOD

BRIEF ON APPEAL

Appeal from Group 1734

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I. **REAL PARTY IN INTEREST**

The real party in interest for this appeal and the present application is L'Oreal, by way of an Assignment recorded in the U.S. Patent and Trademark Office at Reel 01433, Frame 0029.

II. <u>STATEMENT OF RELATED APPEALS AND INTERFERENCES</u>

There are no prior or pending appeals, interferences or judicial proceedings, known to Appellant, Appellant's representative, or the Assignee, that may be related to, or which will directly affect or be directly affected by or have a bearing upon the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 1, 3-10, 12, 13, 21, 22, 24-26, 28-35, 37-43, 46, 47, 56, 57, 60 and 61 are on appeal.

Claims 1, 3-16, 18-22, 24-26 and 28-61 are pending.

Claims 44, 45, 58 and 59 are allowed, and claims 11, 36, 44, 45, 58 and 59 are objected to only for being dependent from a rejected base claim, but are otherwise allowable.

Claims 1, 3-10, 12, 13, 21, 22, 24-26, 28-35, 37-43, 46, 47, 56, 57, 60 and 61 are rejected.

Claims 14-16, 18-20 and 48-55 are withdrawn from consideration.

Claims 2, 17, 23 and 27 are cancelled.

IV. STATUS OF AMENDMENTS

No Amendment After Final Rejection has been filed.

V. SUMMARY OF CLAIMED SUBJECT MATTER

Claims 1, 26, 46 and 47 are the four pending, independent claims. Each of these independent claims is directed to a hot marking method enabling decoration to be made on an article, comprising the following steps: (1) supplying a multilayer structure comprising a layer of varnish that hardens under the effect of radiation, a backing layer, and a layer of decoration, the varnish layer being situated between the backing layer and the decoration layer, (2) bringing the multilayer structure into contact with the article, (3) applying pressure and heat to the backing layer at a location where it is desired to transfer the decoration layer onto the article, the varnish layer being transferred locally onto the article together with the decoration layer, (4) withdrawing the backing layer, and (5) causing the layer of varnish that has been transferred onto the article to harden by exposing it to the radiation.

Claim 1 further requires that the varnish layer and the decoration layer both remain on an external surface of the article after the transfer, that the varnish used is a UV thermal varnish, and that pre-curing of the varnish is initiated by exposure to heat prior to the transfer.

Claim 26 further requires that the decoration layer remains coherent after the transfer on the article, that the varnish used is a UV thermal varnish, and that pre-curing of the varnish is initiated by exposure to heat prior to the transfer.

Claim 46 further requires that the varnish layer and the decoration layer both remain on an external surface of the article after transfer, and that the varnish comprises oligomer of low molecular weight.

Claim 47 further requires that the decoration layer remains coherent after the transfer on the article, and that the varnish comprises that the varnish comprises oligomer of low molecular weight.

To make the multilayer structure shown below (a replication of application Figure 1), the first step is to unroll the backing layer 11 under a first coating member which deposits the

separation layer 13, then the backing layer is brought under a second coating member which deposits the layer of varnish 14 in the non-crosslinked state. The varnish layer 14 is then heated to a temperature that is sufficient to initiate pre-curing, evaporating any solvent. This ensures that the varnish layer is dimensionally stable on the backing layer. Once pre-curing has been initiated, the varnish layer is metallized under a vacuum so as to deposit the decoration layer 15. Adhesive is then deposited to make the adhesive layer 16. See page 5, lines 1-20 of the specification.

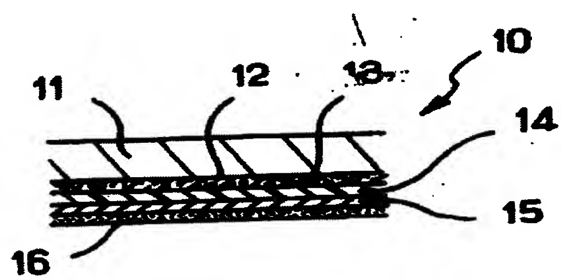

FIG_1

The varnish layer may be constituted by a cationic UV thermal varnish or by a hydroxylated urethane acrylate UV thermal varnish. See page 4, lines 18-20 of the specification. In general, the varnish can have one or two components with or without a solvent, including oligomer of a low molecular weight, such as in the range of 800 to 2000. See page 4, lines 21-24 of the specification.

The multilayer structure 10, once formed, is brought into contact with the outside surface of an article A to be decorated, and a gilding iron F, having portions in relief R corresponding to the pattern to be made, is used to apply pressure and heat to the outside face of the backing layer 11. This is shown in application Figure 3 (below). See page 5, lines 31-37 of the specification.

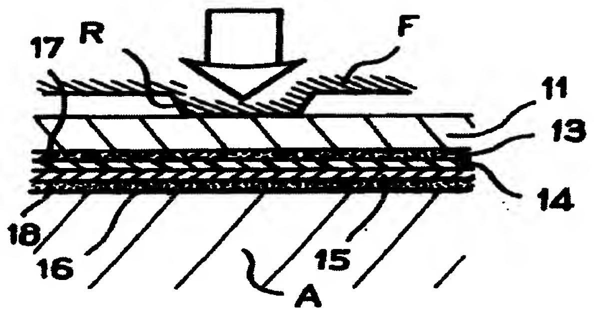

FIG_3

The pressure and the heat from the gilding iron F are transmitted through the various layers of the multilayer structure 10 to the adhesive layer 16, which attached to the article A. When the multilayer structure 10 is withdrawn, as shown below in application Figure 4, the decoration layer 15 remains on the article A at location where pressure and heat were applied locally. The separation layer 13 facilitates detachment of the varnish layer 14. The separation layer 13 remains attached to the backing layer 11 when it is withdrawn. The portions of the decoration layer 15 secured to the article A by the adhesive layer are themselves covered on their outside faces by the varnish layer 14 which is then exposed to short wavelength ultraviolet radiation (UVB) emitted by a source L. See page 6, lines 1-17 of the specification.

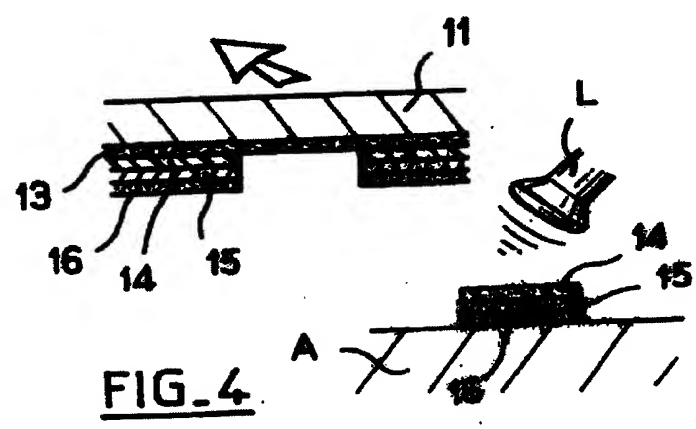

FIG_4

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The following grounds of rejection are presented for review:

1) Claims 1, 4-10, 12, 13, 21, 24-26, 29-35, 37-39, 41, 46, 47, 56, 57, 60 and 61 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over JP 01-202492 ("JP '492") in view of U.S. Patent No. 4,294,641 ("Reed").

2) Claims 3 and 28 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over JP '492 in view of Reed, and in further view of U.S. Patent No. 5,581,978 ("Hekal").

3) Claims 22 and 40 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over JP '492 in view of Reed, and in further view of U.S. Patent No. 4,133,723 ("Howard").

4) Claims 42 and 43 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over JP '492 in view of Reed, and in further view of U.S. Patent No. 5,391,247 ("Kamen") and U.S. Patent No. 1,124,869 ("Davis").

VI. ARGUMENT

A. Claims 1, 4-10, 12, 13, 21, 24-26, 29-35, 37-39, 41, 46, 47, 56, 57, 60 and 61 Would Not Have Been Obvious Over JP '492 in view of Reed

The Examiner alleges that JP '492 in combination with Reed teaches a method enabling decoration of an article using a multilayer structure as recited in the present claims. In particular, the Examiner alleges that the protective layer taught by JP '492 as modified by the transfer layer taught by Reed, which art layers each allegedly correspond to the varnish layer recited in the present claims, would have rendered the present varnish layer obvious.

To this end, the Examiner alleges that JP '492 teaches a method of decorating a substrate comprising the steps of supplying a multilayer structure comprising a release sheet, a layer of radiation curable protective resin, a decorative layer, and a layer of heat activated adhesive; exposing the protective resin layer to radiation to render it partially cured, contacting the multilayer structure with the surface of a target substrate; applying pressure and heat with a heated roller thereby activating the heat activated adhesive layer to bond the decorative and protective resin layer to the target substrate, withdrawing the release sheet, and exposing the transferred layers to further radiation to cause the protective resin layer to fully cure.

The Examiner admits that JP '492 does not teach or suggest a protective layer comprises of a UV thermal varnish that is pre-cured with heat prior to transfer. Instead, JP '492 teaches a protective layer being partially cured by <u>radiation</u> prior to transfer.

The Examiner introduces Reed as allegedly teaching a transfer layer comprised of a UV or thermally curable hydroxylated urethane acrylate such as acrylated polyurethane. The Examiner alleges that it would have been obvious to one of ordinary skill in the art to have substituted the transfer layer of Reed for the protective layer material of by JP '492 to allegedly achieve the varnish recited in the present claims. Appellant strongly disagrees with the Examiner 's allegation.

1. JP '942 and/or Reed do not Teach or Suggest Pre-Curing the Varnish Prior to Transfer

Neither JP '492 nor Reed, in combination or alone, teach or suggest that prior to transfer, pre-curing of the varnish is initiated by exposure to heat as recited in claims 1 and 26. As explained above, JP '492 teaches that the protective layer may be partially cured by irradiation, not by exposure to heat, while Reed teaches that the resin layer is transferred in liquid phase (see column 3, lines 46-53 of Reed). Appellant submits that neither JP '492 nor Reed, alone or in combination, teach that pre-curing the varnish is initiated by exposure to heat prior to transfer as recited in claims 1 and 26.

Moreover, during past interviews, the Examiner has asserted that Reed is introduced to show that the protective layer of JP '492 can be cured by thermal treatment. However, this is not correct.

JP '492 teaches a protective layer that is cured by irradiation, e.g., the protective layer is UV curable. In other words the protective layer taught by JP '492 is not indicated to thermally cure and is not a UV thermal varnish. Moreover, even if the protective layer of JP '492 could be thermally cured, nothing in Reed teaches or suggests using a thermal route to partially cure the protective layer of JP '492 prior to transfer. Reed teaches curing only after transfer, and does not teach or suggest that thermal energy could be used for partial curing as required in JP '492. As such, Appellant submits that Reed does not teach or suggest that the protective layer of JP '492 is a UV thermal varnish, or that one of ordinary skill in the art should use a UV thermal varnish, as required in the present claims.

As discussed above, Reed does not teach or suggest heating the protective layer at all prior to the transfer as recited in claims 1 and 26. Instead, Reed teaches that the resin layer is transferred in liquid phase. Only after transfer is the resin layer in Reed cured. Thus, one of ordinary skill in the art would not have looked to Reed's teachings of a liquid phase transfer to

partially, thermally cure the protective layer of JP '492, prior to any transfer as required in the present claims.

2. One of Ordinary Skill in the Art would not have Combined JP '492 and Reed as Alleged by the Patent Office

Appellant further submits that JP '492 and Reed are directed to different inventions that operate in substantially different manners, and thus one of ordinary skill in the art would not have been led to have combined the teachings of the references as alleged in the Office Action.

As discussed above, JP '492 teaches to have the curable resin half cured by irradiation, and then fully cured after transfer of the layer onto the article. Reed, on the other hand, teaches a method in which the transfer layer is only cured after transfer on the article (there is no partial or pre-cure prior to transfer).

JP '492 aims to avoid having to have a layer of resin that melts under excess heat prior to transfer. Having such a resin layer is indicated to affect the metallic luster of a metal layer. See the translation of JP '492 at page 2, paragraph 3. To address this problem, JP '492 teaches to use a resin that is half cured by irradiation so that the resin has a high heat resistance <u>and cannot melt</u>. See page 3, paragraph 3 of the translation.

Reed, to the contrary, teaches a method in which the resin layer is transferred in a <u>liquid phase</u>, and not in a solid phase as in JP '492. See Reed at column 3, lines 45-50. Furthermore, unlike JP '492, Reed does not teach or suggest transferring a metal layer.

JP '492 and Reed thus teach distinctly different methods, and different materials for use in such methods. One of ordinary skill in the art would have found no motivation in either reference to have combined the references in the manner alleged by the Examiner. JP '492 and Reed thus would not have led one of ordinary skill in the art to the presently claimed invention.

3. Conclusion

For the foregoing reasons, Appellant submits that JP '492 and Reed, in combination or alone, do not teach or suggest all of the features recited in claims 1, 4-10, 12, 13, 21, 24-26, 29-35, 37-39, 41, 46, 47, 56, 57, 60 and 61.

B. Claims 3 and 28 Would Not Have Been Obvious Over JP '492 in view of Reed, and in further view of Hekal

Hekal was introduced by the Examiner as allegedly teaching that the UV thermal varnish is a cationic UV thermal varnish as recited in claims 3 and 28. However, Appellant submits that Hekal does not overcome the deficiencies of JP '492 and Reed. In particular, Hekal also does not teach or suggest that a varnish is partially cured by exposure to heat prior to transfer as recited in claims 1 and 26.

Accordingly, Appellant submits that claims 3 and 28 are patentable over JP '492, Reed and/or Hekal.

C. Claims 22 and 40 Would Not Have Been Obvious Over JP '492 in view of Reed, and in further view of Howard

Howard was introduced as allegedly teaching that the oligomers of the UV thermal varnish have a molecular weight in the range of from about 800 to about 2000 as recited in claims 22 and 40. However, Appellant submits that Howard does not overcome the deficiencies of JP '492 and Reed. In particular, Howard also does not teach or suggest that the varnish is partially cured by exposure to heat prior to transfer as recited in claims 1 and 26.

Accordingly, Appellant submits that claims 22 and 40 are patentable over JP '492, Reed and/or Howard.

D. Claims 42 and 43 Would Not Have Been Obvious Over JP '492 in view of Reed, and in further view of Kamen and Davis

Kamen and Davis were introduced as allegedly teaching a gilding iron used to apply pressure and heat as recited in claims 42 and 43. However, Appellant submits that Kamen

and Davis, in combination or alone, do not overcome the deficiencies of JP '492 and Reed. In particular, Kamen and Davis also do not teach or suggest that the varnish is partially cured by exposure to heat prior to transfer as recited in claims 1 and 26.

Accordingly, Appellant submits that claims 42 and 43 are patentable over JP '492, Reed, Kamen and/or Davis.

VII. CONCLUSION

For all of the reasons discussed above, it is respectfully submitted that the rejections are in error and that claims 1, 3-10, 12, 13, 21, 22, 24-26, 28-35, 37-43, 46, 47, 56, 57, 60 and 61 are in condition for allowance.

For all of the above reasons, Appellant respectfully requests this Honorable Board to reverse the rejections of claims 1, 3-10, 12, 13, 21, 22, 24-26, 28-35, 37-43, 46, 47, 56, 57, 60 and 61.

Respectfully submitted,

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APPENDIX A - CLAIMS APPENDIX

CLAIMS INVOLVED IN THE APPEAL:

1. A hot marking method enabling decoration to be made on an article, comprising:

supplying a multilayer structure comprising a layer of varnish that hardens under the effect of radiation, a backing layer, and a layer of decoration, the varnish layer being situated between the backing layer and the decoration layer;

bringing said multilayer structure into contact with the article;

applying pressure and heat to the backing layer at a location where it is desired to transfer the decoration layer onto the article, the varnish layer being transferred locally onto the article together with the decoration layer;

withdrawing the backing layer; and

causing the layer of varnish that has been transferred onto the article to harden by exposing it to said radiation,

wherein the varnish layer and the decoration layer both remain on an external surface of the article after the transfer,

wherein the varnish used is a UV thermal varnish,

and wherein pre-curing of the varnish is initiated by exposure to heat prior to the transfer.

2. (Canceled)

3. A method according to claim 1, wherein the varnish used is a cationic UV thermal varnish.

4. A method according to claim 1, wherein the varnish used is a hydroxylated urethane acrylate UV thermal varnish.

5. A method according to claim 1, wherein the varnish includes oligomers of low molecular weight.

6. A method according to claim 1, wherein the varnish contains a solvent prior to being applied to the backing layer.

7. A method according to claim 1, wherein the varnish includes at least one of a pigment or a dye.

8. A method according to claim 1, wherein the varnish includes photo-initiators at a concentration by weight that lies in the range from about 0.3% to about 3%.

9. A method according to claim 1, wherein the backing layer comprises a polyester film.

10. A method according to claim 1, wherein the decoration layer is covered in a layer of hot-melt adhesive.

11. A method according to claim 1, wherein the varnish layer is exposed to said radiation while temperature thereof is still close to maximum temperature thereof at the moment when pressure and heat are applied to the backing layer, the temperature difference being less than 30% of the maximum temperature.

12. A method according to claim 1, wherein the decoration layer is a layer of metal.

13. A method according to claim 1, wherein the decoration layer is a layer of ink deposited by printing on the layer of varnish before the varnish is exposed to said radiation.

14. (Withdrawn) A multilayer structure comprising a layer of varnish that hardens under an effect of radiation, a backing layer, and a layer of decoration, the varnish layer being situated between the backing layer and the decoration layer, wherein the varnish used is a UV thermal varnish.

15. (Withdrawn) A multilayer structure for implementing a hot marking method, the structure comprising a layer of varnish that hardens under the effect of radiation, said varnish being unexposed to said radiation, a backing layer, and a layer of decoration suitable for being transferred locally onto an article by applying heat and pressure to the backing layer, the varnish used being a UV thermal varnish.

16. (Withdrawn) A multilayer structure according to claim 15, wherein the decoration layer is covered in a layer of hot-melt adhesive.

17. (Canceled)

18. (Withdrawn) A multilayer structure according to claim 16, wherein the decoration layer is a layer of vacuum-deposited metal.

19. (Withdrawn) A multilayer structure according to claim 15, wherein the decoration layer is a layer of ink deposited by printing.

20. (Withdrawn) An article having decoration applied thereto by a hot marking method as defined in claim 1.

21. A method according to claim 8, wherein the varnish includes photo-initiators at a concentration by weight of about 0.5%.

22. A method according to claim 5, wherein the oligomers have molecular weight lying in a range from about 800 to about 2000.

23. (Canceled)

24. A method according to claim 1, wherein the decoration layer remains coherent after the transfer on the article.

25. A method according to claim 1, wherein the article is made out of plastics material.

26. A hot marking method enabling decoration to be made on an article, comprising:

supplying a multilayer structure comprising a layer of varnish that hardens under the effect of radiation, a backing layer, and a layer of decoration, the varnish layer being situated between the backing layer and the decoration layer;

bringing said multilayer structure into contact with the article;

applying pressure and heat to the backing layer at a location where it is desired to transfer the decoration layer onto the article, the varnish layer being transferred locally onto the article together with the decoration layer;

withdrawing the backing layer; and

causing the layer of varnish that has been transferred onto the article to harden by exposing it to said radiation,

wherein the decoration layer remains coherent after the transfer on the article,

wherein the varnish used is a UV thermal varnish;

and wherein pre-curing of the varnish is initiated by exposure to heat prior to the transfer.

27. (Canceled)

28. A method according to claim 26, wherein the varnish used is a cationic UV thermal varnish.

29. A method according to claim 26, wherein the varnish used is a hydroxylated urethane acrylate UV thermal varnish.

30. A method according to claim 26, wherein the varnish includes oligomers of low molecular weight.

31. A method according to claim 26, wherein the varnish contains a solvent prior to being applied to the backing layer.

32. A method according to claim 26, wherein the varnish includes at least one of a pigment or a dye.

33. A method according to claim 26, wherein the varnish includes photo-initiators at a concentration by weight that lies in the range from about 0.3% to about 3%.

34. A method according to claim 26, wherein the backing layer comprises a polyester film.

35. A method according to claim 26, wherein the decoration layer is covered in a layer of hot-melt adhesive.

36. A method according to claim 26, wherein the varnish layer is exposed to said radiation while temperature thereof is still close to maximum temperature thereof at the moment when pressure and heat are applied to the backing layer, the temperature difference being less than 30% of the maximum temperature.

37. A method according to claim 26, wherein the decoration layer is a layer of metal.

38. A method according to claim 26, wherein the decoration layer is a layer of ink deposited by printing on the layer of varnish before the varnish is exposed to said radiation.

39. A method according to claim 33, wherein the varnish includes photo-initiators at a concentration by weight of about 0.5%.

40. A method according to claim 30, wherein the oligomers have molecular weight lying in a range from about 800 to about 2000.

41. A method according to claim 26, wherein the article is made out of plastics material.

42. A method according to claim 1, wherein a gilding iron having portions in relief corresponding to the pattern to be made is used to apply pressure and heat to the backing layer.

43. A method according to claim 26, wherein a gilding iron having portions in relief corresponding to the pattern to be made is used to apply pressure and heat to the backing layer.

44. A hot marking method enabling decoration to be made on an article, comprising:

supplying a multilayer structure comprising a layer of varnish that hardens under the effect of radiation, a backing layer, and a layer of decoration, the varnish layer being situated between the backing layer and the decoration layer;

bringing said multilayer structure into contact with the article;

applying pressure and heat to the backing layer at a location where it is desired to transfer the decoration layer onto the article, the varnish layer being transferred locally onto the article together with the decoration layer;

withdrawing the backing layer; and

causing the layer of varnish that has been transferred onto the article to harden by exposing it to said radiation,

wherein the varnish layer and the decoration layer both remain on an external surface of the article after the transfer, and wherein the varnish layer is exposed to said radiation while temperature thereof is still close to maximum temperature thereof at time when pressure and heat are applied to the backing layer, a temperature difference between the temperature and the maximum temperature being less than 30% of the maximum temperature.

45. A hot marking method enabling decoration to be made on an article, comprising:

supplying a multilayer structure comprising a layer of varnish that hardens under the effect of radiation, a backing layer, and a layer of decoration, the varnish layer being situated between the backing layer and the decoration layer;

bringing said multilayer structure into contact with the article;

applying pressure and heat to the backing layer at a location where it is desired to transfer the decoration layer onto the article, the varnish layer being transferred locally onto the article together with the decoration layer;

withdrawing the backing layer; and

causing the layer of varnish that has been transferred onto the article to harden by exposing it to said radiation,

wherein the decoration layer remains coherent after the transfer on the article, and wherein the varnish layer is exposed to said radiation while temperature thereof is still close to maximum temperature thereof at time when pressure and heat are applied to the backing layer, a temperature difference between the temperature and the maximum temperature being less than 30% of the maximum temperature.

46. A hot marking method enabling decoration to be made on an article, comprising:

supplying a multilayer structure comprising a layer of varnish that hardens under the effect of radiation, a backing layer, and a layer of decoration, the varnish layer being situated between the backing layer and the decoration layer;

bringing said multilayer structure into contact with the article;

applying pressure and heat to the backing layer at a location where it is desired to transfer the decoration layer onto the article, the varnish layer being transferred locally onto the article together with the decoration layer;

withdrawing the backing layer; and

causing the layer of varnish that has been transferred onto the article to harden by exposing it to said radiation,

wherein the varnish layer and the decoration layer both remain on an external surface of the article after the transfer, and wherein the varnish comprises oligomers of low molecular weight.

47. A hot marking method enabling decoration to be made on an article, comprising:

supplying a multilayer structure comprising a layer of varnish that hardens under the effect of radiation, a backing layer, and a layer of decoration, the varnish layer being situated between the backing layer and the decoration layer;

bringing said multilayer structure into contact with the article;

applying pressure and heat to the backing layer at a location where it is desired to transfer the decoration layer onto the article, the varnish layer being transferred locally onto the article together with the decoration layer;

withdrawing the backing layer; and

causing the layer of varnish that has been transferred onto the article to harden by exposing it to said radiation,

wherein the decoration layer remains coherent after the transfer on the article, and wherein the varnish comprises oligomers of low molecular weight.

48. (Withdrawn) A hot marking method enabling decoration to be made on an article, comprising:

supplying a multilayer structure comprising a layer of varnish that hardens under the effect of radiation, a backing layer, and a layer of decoration, the varnish layer being situated between the backing layer and the decoration layer;

bringing said multilayer structure into contact with the article;

applying pressure and heat to the backing layer at a location where it is desired to transfer the decoration layer onto the article, the varnish layer being transferred locally onto the article together with the decoration layer;

withdrawing the backing layer; and

causing the layer of varnish that has been transferred onto the article to harden by exposing it to said radiation,

wherein the varnish layer and the decoration layer both remain on an external surface of the article after the transfer, and wherein said structure comprises at least one layer of varnish that is colored.

49. (Withdrawn) A hot marking method enabling decoration to be made on an article, comprising:

supplying a multilayer structure comprising a layer of varnish that hardens under the effect of radiation, a backing layer, and a layer of decoration, the varnish layer being situated between the backing layer and the decoration layer;

bringing said multilayer structure into contact with the article;

applying pressure and heat to the backing layer at a location where it is desired to transfer the decoration layer onto the article, the varnish layer being transferred locally onto the article together with the decoration layer;

withdrawing the backing layer; and

causing the layer of varnish that has been transferred onto the article to harden by exposing it to said radiation,

wherein the decoration layer remains coherent after the transfer on the article, and wherein said structure comprises at least one layer of varnish that is colored.

50. (Withdrawn) A method according to claim 48, wherein the colored varnish layer is yellow so as to imitate gold.

51. (Withdrawn) A method according to claim 48, wherein the colored varnish layer has dyes or pigments used for coloring the varnish layer and photo initiators contained therein which have absorption peaks at different wavelengths.

52. (Withdrawn) A method according to claim 48, wherein the decoration layer is a layer of metal.

53. (Withdrawn) A method according to claim 49, wherein the colored varnish layer is yellow so as to imitate gold.

54. (Withdrawn) A method according to claim 49, wherein the colored varnish layer has dyes or pigments used for coloring the varnish layer and photo initiators contained therein which have absorption peaks at different wavelengths.

55. (Withdrawn) A method according to claim 49, wherein the decoration layer is a layer of metal.

56. A method according to claim 12, wherein the layer of metal is deposited under a vacuum onto the layer of varnish before the varnish is exposed to said radiation.

57. A method according to claim 37, wherein the layer of metal is deposited under a vacuum onto the layer of varnish before the varnish is exposed to said radiation.

58. A method according to claim 44, wherein the varnish is partially cured by exposure to heat prior to the transfer.

59. A method according to claim 45, wherein the varnish is partially cured by exposure to heat prior to the transfer.

60. A method according to claim 46, wherein the varnish is partially cured by exposure to heat prior to the transfer.

61. A method according to claim 47, wherein the varnish is partially cured by exposure to heat prior to the transfer.

APPENDIX B - EVIDENCE APPENDIX

A copy of the following item of evidence relied on by the Appellant and the Examiner is attached:

English-language translation of JP 01-202492

Japanese Un-Examined Patent Publication Hei 1-202492

SPECIFICATION

1. Title of the Invention

Transfer Sheet Provided with Curable Protective Layer and Transfer Method

2. What is claimed is:

(1) A transfer sheet comprising, on the releasable surface of a releasable sheet, a protective layer consisting of a curable layer of a half-cured, ionizing radiation-curable resin, which is a solid at ordinary temperature in its uncured state, which has thermoplasticity and which can protect sublayers after the transfer thereof and at least a metal thin layer, in this order.

(2) The transfer sheet as set forth in claim 1, wherein it comprises a layer consisting of a thermoplastic resin arranged between the curable layer and the metal thin layer.

(3) A transfer method comprising the steps of carrying out transfer on the surface of a body to which a transfer sheet is applied using the transfer sheet as set forth in claim 1 or 2 and then irradiating the resulting assembly with ionizing radiations to thus crosslink and cure the transferred protective layer.

3. Detailed Description of the Invention

[Industrial Field of the Invention]

The present invention relates to a transfer sheet, which permits the formation of a protective layer excellent in its surface strength through transfer as well as a transfer method, which can be put in operation using the transfer sheet.

[Prior Art]

Up to now, it has been tried to form the layer of a transfer sheet, which serves as the outermost layer after the transfer of the transfer sheet, using a curable resin as a material for the protection of, for instance, a pattern or design from any abrasion and any deterioration due to chemicals. In particular, it is quite advantageous to prepare such a protective layer from a UV-curable resin or an electron beam-curable resin as a material, since any heat is not needed to cure the resin and the resin can instantaneously be cured.

However, the usual UV-curable resins and electron beam-curable resins have stickiness in their uncured states and therefore, the following problems arise. For instance, it is difficult to apply a subsequent layer onto the layer thereof after the application and/or printing of these resins and when it is intended to apply a subsequent layer onto the resin layer after curing the same, the adhesion between them would not be acceptable.

In addition, the resulting transfer sheet has a high overall rigidity since the protective layer thereof is cured. Accordingly, the transfer sheet can be used for the transfer thereof to a flat plate-like surface without any trouble, but it is difficult to transfer the same onto an uneven surface because of the extremely low deformability of the protective layer.

For this reason, it has been tried to form the protective layer of such a transfer sheet using ionizing radiation-curable resin, which is a solid at ordinary temperature in its uncured state. Such a resin can be dissolved in a solvent before the formation of a protective layer through the application or printing of the resulting solution and any subsequent layer may be formed on the resulting layer of the foregoing resin through the application or printing of a material for the subsequent layer without irradiating the layer with ionizing radiations after the application of the protective layer, while ensuring good adhesion between these layers. Further, the resulting protective layer is deformable like the layer of a thermoplastic resin. Accordingly, the resulting transfer sheet provided thereon with such a protective layer can be used for the transfer of such a protective layer onto uneven or rough surfaces and the resulting transfer sheet can be used for the transfer of the protective layer and the transfer sheet thus transferred can then be irradiated with ionizing radiations to cure the protective layer thereof and to thus improve physical and/or chemical strength of the resulting surface.

However, the foregoing protective layer suffers from a problem detailed below. The protective layer on the transfer sheet prior to the transfer thereof is not yet cured, the heat resistance thereof is accordingly identical or inferior to that observed for the thermoplastic resin, the protective layer is melted into a fluid if excess heat is applied thereto when transferring the same, this fluid or melt may adversely affect the metal thin layer and the metallic luster of the thin layer would be reduced.

[Problems that the Invention is to Solve]

It is an object of the present invention to solve the foregoing problems observed when forming a protective layer by the use of "an ionizing radiation-curable resin, which is a solid at ordinary temperature in its uncured state and which has thermoplasticity".

[Means for the Solution of the Problems]

According to the present invention, the foregoing object can be accomplished by the formation of such a protective layer using "an ionizing radiation-curable resin, which is a solid at ordinary temperature in its uncured state and which has thermoplasticity" and by half-curing the protective layer.

More specifically, the gist of the present invention resides in the following:

"A transfer sheet comprises, on the releasable surface of a releasable sheet, a protective layer consisting of a curable layer of a half-cured, ionizing radiation-curable resin, which is a solid at ordinary temperature in its uncured state, which has thermoplasticity and which can protect sublayers after the transfer thereof, and at least a metal thin layer, in this order" and

"A transfer method comprises the steps of carrying out transfer on the surface of a body to which a transfer sheet is applied using the transfer sheet specified above and then irradiating the resulting assembly with ionizing radiations to thus crosslink and cure the transferred protective layer."

[Operation of the Invention]

According to the present invention, the protective layer of the transfer sheet is half-cured in advance and therefore, the layer has high heat resistance. As a result, the protective layer never suffers from such a problem that it is melted into a fluid due to the heat applied thereto during the transfer of the sheet, this fluid or melt may adversely affect the metal thin layer and the metallic luster of the thin layer would be eliminated or reduced.

Moreover, the protective layer is not completely cured prior to the transfer thereof. Therefore, the transfer sheet has an ability of transferring a protective layer even to uneven surfaces and the protective layer can be cured after the transfer of the same.

[Specific Description of the Constitution]

According to the simplest embodiment, the transfer sheet of the present invention comprises three layers or a release sheet, a protective layer and a metal thin layer. Other structural characteristics of the transfer sheet will be described later.

Release Sheet

Materials for forming such a release sheet may, in principle, be any one commonly used in the preparation of such a transfer sheet and it is common that the thickness of the sheet is preferably set at a level ranging from 5 to 200 μ m and more preferably 12 to 50 μ m.

Specific examples of materials for the release sheet are films of synthetic resins such as polyethylene terephthalate (so-called polyester), polypropylene, polyethylene and polyamide films; paper; and synthetic paper, which may, if necessary, be used in combination or as a laminate.

The unevenness of the surface of the release sheet determines the unevenness of the surface of the protective layer observed after the transfer thereof. Accordingly, if it is intended to obtain a mirror-finished surface after the transfer, the release sheet

should have a mirror-finished surface. Alternatively, for the ornamental applications, it would often be required for the release sheet to have a matted surface and in such cases, it is recommendable to use, as such a release sheet, a matted film whose luster is controlled by a means such as a method comprising incorporating a matting agent into a material for the film through kneading, a sandblasting technique or a chemical etching technique.

Examples of release sheets also include sheets whose surfaces are made releasable by separately applying a releasable layer, in addition to those prepared from the foregoing materials.

This releasable layer comprises a component, which permits the release of the protective layer from the basic sheet of a transfer sheet when transferring the protective layer on the transfer sheet and more specifically, the releasable layer may be prepared from an appropriate vehicle (examples of such vehicles are identical to those listed below as vehicles used in the usual ink composition) alone or, if necessary, in combination with a releasing agent such as wax and silicone.

Protective Layer

The protective layer used herein is formed from, an ionizing radiation-curable resin, as a raw material, which is a solid at ordinary temperature in its uncured state, which is thermoplastic and soluble in a solvent, which can provide a non-fluidized and non-adhesive coated film, apparently or when touching the same with the hand, after the application and drying of the solution containing the same and which is half-cured prior to the practical use thereof.

As such resins, there have been known the following two kinds of thermoplastic resins having radical-polymerizable unsaturated groups:

(1) Polymers whose glass transition points fall within the range of from 0 to 250℃ and having radical-polymerizable unsaturated groups in the molecules:

More specifically, resins usable herein are products obtained by polymerizing or copolymerizing the following compounds (i) to (viii) and then incorporating radical-polymerizable unsaturated groups into the resulting polymers or copolymers according to the methods (a) to (d) as will be detailed later:

(i) Monomers having hydroxyl groups such as N-methylol (meth)acrylamide, 2-hydroxyethyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate, 2-hydroxybutyl (meth)acrylate and 2-hydroxy-3-phenoxypropyl (meth)acrylate;

(ii) Monomers having carboxyl groups such as (meth)acrylic acids and (meth)acryloyloxy-ethyl mono-succinate;

(iii) Monomers having epoxy groups such as glycidyl (meth)acrylate;

(iv) Monomers having aziridinyl groups such as 2-aziridinyl-ethyl (meth)acrylate and allyl 2-aziridinylpropionate;

(v) Monomers having amino groups such as (meth)acrylamide, di-acetone (meth)acrylamide, dimethylaminoethyl (meth)acrylate and diethylamino-ethyl (meth)acrylate;

(vi) Monomers having sulfon groups such as 2-(meth)acrylamido-2-methylpropane sulfonic acid;

(vii) Monomers having isocyanate groups such as adducts of diisocyanates such as 1:1 (molar ratio) adducts of 2,4-toluenediisocyanate and 2-hydroxyethyl (meth)acrylate with active hydrogen-containing radical-polymerizable monomers;

(viii) Further, the foregoing compounds may be copolymerized with the following monomers copolymerizable with the foregoing compounds in order to control the glass transition points of the resulting copolymers such as those specified above or to control the physical properties of the resulting cured films. Specific examples of such monomers copolymerizable with the foregoing compounds include methyl (meth)acrylate, ethyl (meth)acrylate, propyl (meth)acrylate, butyl (meth)acrylate, isobutyl (meth)acrylate, t-butyl (meth)acrylate, isoamyl (meth)acrylate, cyclohexyl (meth)acrylate and 2-ethylhexyl (meth)acrylate.

Then radical-polymerizable unsaturated groups can be introduced into the polymers prepared according to the foregoing methods by subjecting them to reactions according to the following methods (a) to (d) to thus give ionizing radiation-curable resins.

(a) In case of polymers or copolymers of monomers having hydroxyl groups, they are subjected to condensation reactions with, for instance, monomers having carboxyl groups such as (meth)acrylic acids.

(b) In case of polymers or copolymers of monomers having carboxyl groups or sulfon groups, they are subjected to condensation reactions with monomers having hydroxyl groups such as those specified above.

(c) In case of polymers or copolymers of monomers having epoxy, isocyanate or aziridinyl groups, monomers having hydroxyl groups or monomers having carboxyl groups such as those specified above are added to these polymers or copolymers.

(d) In case of polymers or copolymers of monomers having hydroxyl groups or carboxyl groups, they are subjected to addition reactions with 1:1 (molar ratio) adducts of monomers having epoxy groups or monomers having aziridinyl groups or di-isocyanate compounds with hydroxyl group-containing acrylic acid ester monomers.

In this connection, it is desirable that the foregoing reactions be conducted while

adding a trace amount of a polymerization inhibitor such as hydroquinone and supplying dry air to the reaction systems.

(2) Compounds whose melting points fall within the range of from ordinary temperature (20℃) to 250℃ and having radical-polymerizable unsaturated groups: Specific examples thereof are stearyl acrylates, stearyl (meth)acrylate, tri-acryl isocyanurate, cyclohexane diol diacrylate, cyclohexane diol di-(meth)acrylate, spiro-glycol diacrylate and spiro-glycol di-(meth)acrylate. Moreover, in the present invention, the foregoing compounds (1) and (2) may likewise be used in combination and a radical-polymerizable unsaturated monomer may be added to the compounds or mixture thereof. The radical-polymerizable unsaturated monomer serves to improve the crosslink density and the heat resistance of the polymers or copolymers upon the irradiation thereof with ionizing radiations. Specific examples thereof usable herein include, in addition to the monomers specified above, ethylene glycol di-(meth)acrylate, polyethylene glycol di-(meth)acrylate, hexanediol di-(meth)acrylate, trimethylolpropane tri(meth)acrylate, trimethylolpropane di-(meth)acrylate, pentaerythritol tetra(meth)acrylate, pentaerythritol tri(meth)acrylate, di-pentaerythritol hexa(meth)acrylate, ethylene glycol di-glycidyl ether di-(meth)acrylate, polyethylene glycol di-glycidyl ether di-(meth)acrylate, propylene glycol di-glycidyl ether di-(meth)acrylate, polypropylene glycol di-glycidyl ether di-(meth)acrylate, and sorbitol tetra-glycidyl ether tetra(meth)acrylate. The radical-polymerizable unsaturated monomer is preferably used in an amount ranging from 0.1 to 100 parts by mass per 100 parts by mass of the solid content of the foregoing copolymerized mixture. Further, the foregoing materials for the protective layer can satisfactorily be cured by the irradiation with ionizing radiations, but when they are cured through the irradiation with UV light rays, a sensitizing agent may be used and examples thereof are benzoin ethers such as benzoquinone, benzoin and benzoin methyl ether; and those capable of generating radicals through the irradiation thereof with UV light rays such as halogenated acetophenones and biacetyl.

Half-Curing

In the present invention, the protective layer consisting of the material specified above is half-cured.

In this respect, the term "half-cure" means a condition in which the reaction in the protective layer is not yet completed and in case of a UV-curable resin, a part of the photopolymerization initiator undergoes cleavage and takes part in the reaction, while the rest of the initiator remains uncleaved.

The degree of half-cure of the protective layer corresponds to such an extent that

when the protective layer is subsequently irradiated with ionizing radiations, the characteristic properties thereof can considerably be improved. In this respect, it is sufficient that the protective layer has a relatively low degree of curing in the present invention. By way of example, such a degree of curing corresponds to that achieved when the protective layer is once conveyed at a speed of 30 m/min while irradiating the layer with light rays emitted from a high-pressure mercury lamp of 80 W/cm and in this case, the resulting half-cured film starts dissolution when it is rubbed over ten times in the presence of methyl ethyl ketone. In this connection, the protective layer is completely cured when it is conveyed at a speed of 5 m/min over ten times while irradiating the layer with light rays emitted from the same high-pressure mercury lamp and the resulting cured product never shows any abnormality even when it is rubbed over 200 times in the presence of methyl ethyl ketone.

Alternatively, the degree of such half-cure is determined while taking into consideration the characteristic properties required for the protective layer.

For instance, when a paint whose glass transition point is 50℃ in its uncured state is used and when the temperature thereof upon transfer is raised up to 70℃, the protective layer is melted and starts flowing due to the heat applied when it is transferred. Accordingly, the protective layer may be cured to such an extent that the glass transition point thereof is increased to 80℃ to thus prevent any flow of the layer upon the transfer thereof. Thus, the cured condition of the protective layer on the transfer sheet lies in the region between the uncured state and the completely cured state and can be determined in such a manner that it can maintain sufficiently high heat resistance at a temperature at which the transfer sheet is put into practical use.

The dose of the irradiated light rays required for this half-curing operation may arbitrarily be determined depending on the temperature at which the transfer sheet is used and it preferably ranges from 1 to 80% and more preferably 1 to 50% of that required for the complete curing of the protective layer.

The ionizing radiations used for the half-cure of the protective layer and for the complete curing thereof after the transfer of the transfer sheet are not restricted to specific ones and specific examples thereof include UV light rays emitted from a high-pressure mercury lamp, a metal halide lamp, a xenon lamp or a low-pressure mercury lamp; or electron beams emitted from electron beam sources such as a curtain type one or a scanning type one used in accelerators, which makes use of a tungsten filament.

The protective layer may be irradiated with ionizing radiations for the half-cure thereof through either the side of the release sheet or the side opposed thereto, but

when the release sheet is pigmented or opaque and UV light rays are used for the half-cure, the UV rays are preferably applied through the side opposed to the release sheet.

Moreover, UV light rays or electron beams are preferably applied to the protective layer for the complete curing of the same through the side opposed to the release sheet, from the viewpoint of the effective use of energy.

Metal Thin Layer

This metal thin layer is one for imparting metallic appearance to the surface of a body to which the transfer sheet or the protective layer is applied and examples of materials for preparing such a metal thin layer are aluminum, chromium, tin, silver, copper and gold. The thickness of the metal thin layer is in general on the order of about 400 to 600Å. In this respect, the metal thin layer may, if necessary, have a pattern and the thin layer may be patterned by a method comprising the steps of forming a water-soluble pattern, depositing a metal thin film thereon and then acting water on the pattern; or a method comprising the steps of first depositing a metal thin film, forming a resist pattern and then acting an acid or an alkali on the metal film.

Patterned Layer

The patterned layer is one for imparting a pattern to a body to which a protective layer is applied through the transfer of a transfer sheet and is not an essential component. A patterned layer may be positioned between the protective layer and the metal thin layer to thus achieve a more excellent aesthetic effect.

Moreover, when a metal thin layer is partially formed, a patterned layer may be arranged in such a manner that one can see the pattern through the area free of any metal thin layer.

The patterned layer may directly be applied onto a protective layer or may indirectly be applied thereto through another layer and the kinds of ink to be used may likewise be determined depending on the applications and structure of each transfer sheet. The usual ink is a product prepared by admixing, for instance, a vehicle, a coloring agent such as a pigment or a dye, a plasticizer, a stabilizer and other additives or a solvent or a diluent through kneading.

Among the components of the ink, binders related to the adhesive properties thereof and usable herein preferably include at least one member selected from the group consisting of alcohol-insoluble resins, for instance, polymer or copolymer of acrylic or methacrylic monomer or copolymers containing these monomers such as poly(methyl methacrylate), poly(ethyl methacrylate), poly(ethyl acrylate) and poly(butyl acrylate); styrene resins and styrene copolymer resins such as polystyrene

and poly(α-styrene); cellulose acetate; polyvinyl chloride; and polyester resins.

These resins are, if necessary, diluted to a viscosity level suitable for coating operations and then applied to the protective layer according to any known coating technique such as reverse-roll coating, roll coating, gravure coating, kiss-roll coating, blade coating and smooth coating techniques.

In the transfer sheet of the present invention, other layers thereof may likewise be prepared by a method almost identical to that described above, provided that when forming a layer in a pattern, a printing technique is used.

The structure of the transfer sheet is fundamentally one detailed above, but the structure may, if necessary, further include the following various layers.

<u>Layer of Solvent-Volatile type Resin</u>

A layer of a solvent-volatile type resin, for instance, a thermoplastic resin may be arranged between the cured layer (or protective layer) and a layer directly in contact with the protective layer such as a metal thin layer, prior to the formation of the metal thin layer.

It is desirable to select a resin capable of ensuring good adhesion to the subsequent layer as such a solvent-volatile type resin.

<u>Adhesive Layer</u>

An adhesive layer is used for the improvement of the adhesion between the metal thin layer (or another additionally deposited layer) and the body to which the transfer sheet is applied (hereunder simply referred to as "transfer substrate") and, in general, a heat-sensitive adhesive is suitably used. Materials for such adhesives may be known ones.

<u>Transfer Method</u>

The transfer sheet of the present invention can be transferred to a transfer substrate according to an appropriate method and then the transferred protective layer is completely cured by the irradiation thereof with ionizing radiations to thus form a completely cured film on the surface of the transfer substrate. In this respect, the release sheet may be removed, in some cases, prior to the irradiation with ionizing radiations or it may be removed, on the other hand, after the irradiation.

Examples of transfer methods include (i) a heat transfer method comprising the step of attaching the metal thin film (or optionally another layer additionally deposited on the metal thin layer) of a transfer sheet to a transfer substrate using heat and pressure to thus transfer the metal thin layer together with the protective layer; (ii) a solvent-activated transfer method comprising the step of transferring a transfer sheet to a transfer substrate through a liquid activation layer consisting of a solvent or a

solution of a resin in a solvent and arranged between the sheet and the substrate; and (iii) a simultaneous molding-transfer method comprising the steps of placing a transfer sheet within a mold for injection molding and then injection-molding a resin to thus simultaneously mold the resin and transfer the transfer sheet while making use of the heat and pressure of the resin.

Body To Which Transfer Sheet Is Applied (Transfer Substrate)

The transfer sheet provided thereon with a curable protective layer according to the present invention may be applied to a wide variety of bodies to which the layer(s) of the transfer sheet can be transferred (transfer substrates) and examples thereof will be listed below:

Those used as basic materials for decorative materials, for instance, (i) paper such as bleached kraft paper, titanium paper, linter paper, paperboard and gypsum liner board; (ii) plastic films such as polyethylene films, polypropylene films, polyvinyl chloride films, polyvinylidene chloride films, polyvinyl alcohol films, polyethylene terephthalate films, polycarbonate films, nylon films, polystyrene films, ethylene-vinyl acetate copolymer films, ethylene-vinyl alcohol copolymer films and ionomers films; (iii) wooden basic materials such as wood, plywood and particle board; (iv) gypsum-containing basic materials such as gypsum wall board and gypsum slag board; (v) fiber cement boards such as pulp cement board, asbestos cement board and cemented chip board; and (vi) other materials such as GRC and concrete plates, metal foils or sheets of, for instance, iron, aluminum and copper as well as composite materials of the foregoing materials (i) to (vi).

Alternatively, various kinds of molded articles may likewise be used as the transfer substrates and materials for such molded articles may, for instance, be those listed below although these examples and those listed above in connection with the basic materials for decorative materials partially overlap one another:

Plastic molded articles of, for instance, AAS resins, ABS resins, ACS resins, amino resins, cellulose resins such as cellulose acetate, cellulose acetate butyrate and ethyl cellulose, allyl resins, ethylene-α-olefin copolymers, ethylene-vinyl acetate copolymers, ethylene-vinyl chloride resins, ionomer resins, MBS resins, methacrylate-styrene copolymers, nitrile resins, phenolic resins, polyamide resins, polyacrylate resins, polycarbonate resins, polybutadiene resins, polybutylene terephthalate resins, polyethylene resins, polyethylene terephthalate resins, poly(methyl methacrylate) resins, polypropylene resins, poly(phenylene oxide) resins, polystyrene resins, AS resins, polyurethane resins, polyvinyl chloride resins, acrylic-modified polyvinyl chloride resins and unsaturated polyester resins; and

Extrusion-molded articles of metals such as iron, aluminum, copper and stainless steel.

When transferring to the plastic molded articles among the foregoing materials, the transfer sheet of the invention is transferred thereto by a method in which the sheet is transferred to a preliminarily molded article or the foregoing simultaneous molding- transfer method in which the transfer is conducted simultaneous with the molding of an article to which the transfer sheet is applied.

The surfaces of these transfer substrates, to which the transfer sheet is applied, may be subjected to a pretreatment suitably selected while taking into consideration the materials for the transfer substrate surfaces and specific examples of such pretreatments include those for the improvement of the adhesive properties such as a treatment with a primer and a corona discharge treatment; coating treatments and other treatments for controlling the color of the substrate surface; sealing treatments; and alkali exudation-inhibitory treatments required for alkaline basic materials such as cement.

[Effects of the Invention]

According to the present invention, the protective layer on the transfer sheet is half-cured and therefore, the protective layer has heat resistance superior to that observed for the protective layer in its uncured state and this in turn permits the prevention of any flowing and/or unnecessary deformation of the protective layer due to the heat applied to the transfer sheet upon the transfer thereof. Accordingly, the transfer sheet can be transferred to a desired transfer substrate without exerting any harmful effect on the metal thin layer of the sheet and accordingly, the metal thin layer after the transfer never undergoes any reduction in its luster.

In addition, the half-cured protective layer can be converted into a completely cured one by the irradiation thereof with ionizing radiations after the transfer.

[Examples]

One side of a polyester film (LUSART available from REIKO Inc. and having a thickness of 25 μ m) as a release film was coated with a melamine-acrylate type UV-curable resin (available from Mitsubishi Petrochemical Co., Ltd. under the trade name of YUPIMAR LZ-075) diluted with methyl ethyl ketone according to the gravure coating technique, followed by drying of the coated layer or film using hot air of 100℃ to thus solidify the film (having a film thickness of 6 μ m) and the subsequent application of urethane resin-containing paint (available from Showa Ink Co., Ltd.) as a solvent-volatile resin layer to a film thickness of 1 μ m according to the gravure coating technique.

The polyester film obtained after the coating of the foregoing two layers was conveyed at a velocity of 30 m/min while irradiating the film with light rays emitted from a high-pressure mercury lamp (160 W/cm; ozone-containing type one) in such a manner that the UV light rays are incident upon the side of the film free of any coating layer to thus half-cure the film of the foregoing UV-curable resin.

Then aluminum was deposited on the film according to the vacuum vapor deposition technique such that the thickness of the resulting aluminum thin film was controlled to 500 Å and further an acrylic heat-sensitive adhesive (available from Showa Ink Co., Ltd.) was applied onto the aluminum thin film to a thickness of 2 μ m.

The resulting transfer sheet was transferred to an AS plate using a heated roller having a surface temperature of 200℃ and the polyester film was peeled off after the completion of the transfer.

Thereafter, the face of the AS plate having the transferred sheet was irradiated with UV light rays from a high-pressure mercury lamp (ozone-containing type one; 80 W/cm) for 5 seconds to thus completely cure the protective layer.

As a result, it was found that the molded article thus obtained was excellent in the metallic luster originated from the metal thin layer and the article was never damaged even when it was rubbed with #0000 steel wool.

As a comparative example, a transfer sheet was prepared by repeating the same procedures used above except that the protective layer was not half-cured or remained uncured and then the sheet was used in the same transfer operation. As a result, it was found that the metallic luster of the transfer sheet disappeared after the transfer operation.

APPENDIX C - RELATED PROCEEDINGS APPENDIX

Copies of relevant decisions in the following related proceedings are attached:

NONE